Available online at www.sciencedirect.com

ScienceDirect

Procedia - Social and Behavioral Sciences 226 (2016) 414 – 422

Procedia
Social and Behavioral Sciences

29th World Congress International Project Management Association (IPMA) 2015, IPMA WC 2015, 28-30 September – 1 October 2015, Westin Playa Bonita, Panama

Adaptive management approach to an infrastructure project

Marek Wirkus*

Gdansk Uniwersity of Technologys, Narutowicza 11/12, Gdansk, 80-233. Poland

Abstract

The paper presents an adaptive approach to project management, illustrated by the description of a case study, i.e., of a project whose aim was to develop the means and prepare the documentation for the revitalization of a railway line. The project itself was a major challenge for the implementers due to a novel and innovative subject thereof, including the construction of a railway line which takes place in a difficult terrain and within the constraints of urban planning. Because of the situation, among other things, or the number of unknowns regarding the result of the project and the principles of its operation, adaptive approach was used to obtain proper results. This approach is mainly applied in IT environments, but the current project attempts to utilize the same principles to an infrastructure project. The paper characterizes the adaptive approach and based on the use thereof, illustrates the preparation of project documentation for the construction of an urban railway line.

Peer-review under responsibility of the organizing committee of IPMA WC 2015.

Keywords: adaptive project management, adaptation, project success

1. Introduction

Project delivery has recently started to require a flexible approach. This need results from the fact that projects are delivered in a changing, and therefore more unpredictable, environment, which translates directly to the way a project is conducted and the interested parties' expectations towards its outcome. Such a situation makes it complicated to plan the course a project might take as well as subsequently deliver the project according to the accepted flow. The need for a flexible approach is apparent in IT projects within the field of software engineering and in innovative projects covering various branches but always including a big measure of research and development activity. However, because of the abovementioned changes in the environment, the need for a flexible

* Corresponding author. Tel.: +48 58 347 15 24;.
E-mail address: mwir@zie.pg.gda.pl

Peer-review under responsibility of the organizing committee of IPMA WC 2015.
doi:10.1016/j.sbspro.2016.06.206

approach is becoming apparent in projects that used to be considered as predetermined and predictable in their process of execution. The author of this article analyzed an infrastructure project whose very name was being developed when the project was already running and which is currently referred to as Pomeranian Metropolitan Railway, PKM in Gdańsk, Poland. The aim of the project was to develop the functional and documentation aspects of constructing innovative communication infrastructure. Within the scope of the project, the flexible approach took the form of adaptive methods.

2. Classic methods versus adaptive approach

In classic methodology or TPM – Traditional Project Management – a three-stage, or sometimes a five-stage if referencing the PMBOK® Guide (2013), model of project delivery is quoted. It consists of the following stages:

- Initiation (defining);
- Planning;
- Performance (the actual delivery);
- Progress monitoring and control;
- Closing the project.

The core idea of the traditional approach to project execution is the fact that the sponsor / customer defines, at the initiation stage of the project, or sometimes even before this point, what they want the project to achieve and when the achievement is to be completed, as well as what the cost of the project delivery will be. In traditional methods, the planning stage provides the detailing and definitions to a number of factors that are crucial for the proper course of project performance. At the beginning of the performance stage, the result of the project has therefore already been properly defined. The projects are executed according to a detailed plan, which is approved before the project proceeds to the performance stage, and the individual task groups receive precisely-stated goals and tasks to be carried out. During project delivery, no or only limited deviations from the original design are assumed.

A situation in which at the beginning of project delivery its outcome is clearly and completely defined is rather uncommon in economical practice. Currently, one may more often find projects where only the goal is defined, in general terms, and the maximum budget may be assumed, but neither the precise product nor the way of reaching the stated general goals are known.

Such conditioning forces the project responsibles to search for more flexible rules of conduct than those assumed in classical methods. This has led to the development of the first project management rules taking into account the external conditioning on an ongoing basis and the intermittent milestones, primarily in IT projects, in the 1990s. Such methods are referred to as agile methods because they follow the rules introduced in The Agile Manifesto.

Adaptive project management (APM) is one of the fundamental agile methods – a group that also encompasses SCRUM of software development (Schwaber, 2005), Adaptive Software Development ASD (Wysocki & McGary, 2005; Wirkus & Węsierski, 2011). and the like.

The essential differences between the classical project management methods and the adaptive ones are presented in Fig. 1.

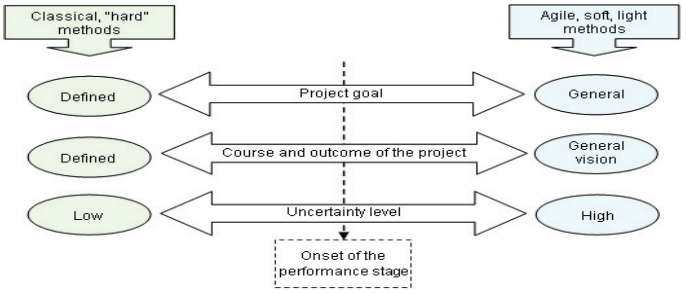

Fig. 1. Fundamental differences between classical and agile methods.

The adaptive approach is still undergoing development. There has been an attempt of using this method in the management of an infrastructure project. Unlike with typical projects, where "what to do" and "how to do it" are predefined, during most of the lifecycle of the analysed project its final outcome and the measure of its success were unknown. The delivery of the said project was characterized from the very beginning by a high level of uncertainty.

3. Characteristic elements of the adaptive approach

Adaptive project management assumes that in the light of having no knowledge as to the subject of the project, its delivery progresses in individual steps, divided into stages and iterations.

At the stage of defining and planning, a general plan of the whole project is outlined, reflecting the intention of delivering the said project and including a general vision thereof, encompassing the problem to be solved, the goals of the endeavour and – potentially – other known and assumed values that are vital for the main interested parties, e.g. sources and amount of financial outlays, expected deadlines, risk factors that may result in the project's failure.

At the execution stage, the adaptive approach divides the project into smaller segments – iterations, each of which concludes in a partial result, relevant to the general goal of the project. The idea of division into iterations assumes gradual analysis of smaller and more manageable sections of the final outcome, frequently opening with a wider picture and progressing to details. For example, in the initial iterations the final outcome is analyzed holistically, while in the subsequent iterations each fragment of the final product is scrutinized in more detail. Individual iterations are executed in short, but not always identical, time spans. Iterations are sets of repetitive, purposefully selected tasks. Such a set usually consists of the following:

- First Detailed planning, where input data is analyzed and the iteration's scope of work is defined;
- Performance of the planned tasks, i.e. individualized, according to the scope of the task, set of executive processes related to the completion of the iteration's core concept, collecting of the task's conditioning data and opinions related to it, creating new knowledge, etc.
- Closing the iteration, where team assessment of the result is performed, and guidelines for future iterations are established.

The diagram of activities within the adaptive approach to project delivery is presented in Fig. 2.

The outcome of each iteration is a complete product or a part thereof. Finishing an iteration is a control and planning milestone within the project delivery process. At this point, the project team reviews the results of the last iteration. If any of the tasks designated to be performed in a given iteration have not been concluded, the team's management establishes further approach to the given issue. If the results of the last iteration (or the last few iterations conducted simultaneously) are satisfactory, they are presented to the sponsor / customer and the achievements to date are verified, together with the assessment of whether these achievements are satisfactory and what still needs to be corrected. The sponsor / customer is responsible for announcing whether the goals of the iteration have been achieved. If their assessment is positive, the results of the iteration are approved, and after being "frozen" in a given state are adopted into future iterations. If the results of the iteration decidedly fail to meet the requirements of the sponsor / customer, a decision is undertaken to either repeat the concluded activities or adapt future tasks to the obtained results.

During a review meeting, serving to assess the results of the last iteration, the project team also develops a detailed plan of the consecutive iteration, describing the future actions to be undertaken. Thanks to such an approach, it is possible to adapt the project delivery flow – change the course and the result of the project considering the achievements to date and current conditions; optionally, the team may start focusing on the gradually clearer customer requirements, once they are precise enough. When planning the goals and scope of work for future iterations, the remarks and requirements voiced by the customer / sponsor are, naturally, taken into account. This way, all the reservations and modifications are analyzed and may be successively introduced into the project scope. A situation where the delivery of the complete project is adapted in relation to the results achieved so far is also possible, as well as incorporating the important decisions undertaken in the meantime in the project's environment.

In such an event, the scope of the project or its goal may be changed, followed by altering its structure (consisting of a number of isolated iterations). As a consequence, the project's budget and timing may also be altered.

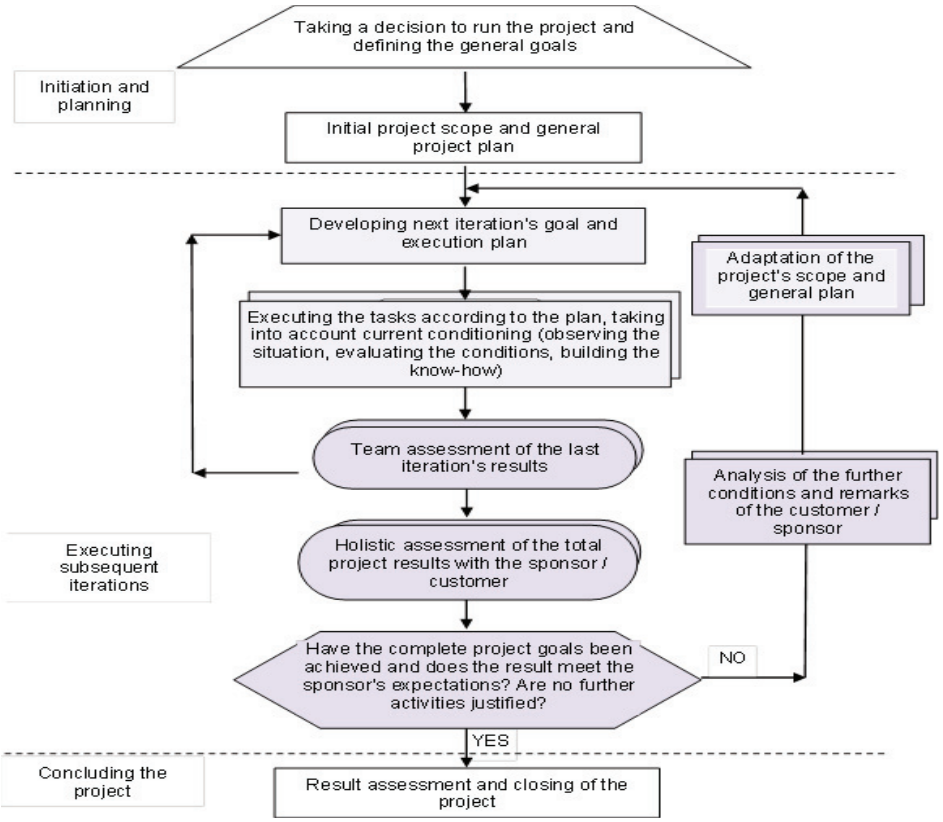

Fig. 2. Iterations as seen in the adaptive project delivery approach.

The course of a project and solutions being developed are therefore adapted to the final outlooks of the sponsor / customer and result in a product that meets these expectations. An adaptive project is concluded successfully when the customer / sponsor accepts the achieved result of the performed tasks.

4. Organizational solutions in an adaptive-managed project

The adaptive approach does not call for organizational solutions to be a subject of detailed advance planning, but instead these are created "on the fly" and adapted to the current scope of work and achievements, as well as are the work plans and goals for the future stages.

Such an approach assumes the need of constant adaptation of the project's scope and delivery rules, taking into account the changes occurring during project execution and those coming from the external environment. A rule is therefore applied, according to which the composition of the project team will also be adapted to the current scope of work. It is assumed that certain team members are involved in the project activities on a constant basis and that specific people are unambiguously defined as the formal "managers" of specialist areas, i.e. "managers" of individual iterations, while others are temporary team members whose existence in the team depends on the thematic scope of actions being carried out in a given iteration. At a specified moment, the "manager" of an iteration ought to focus on the management of the course of his/her iteration.

Each case which is both important for the iteration and problematic in its execution needs to be discussed during regularly organized meetings of all team members, in order to collect the opinions of specialists from different fields of activity. When atypical problems occur, a brainstorm may be used to address the issue and prepare a completely new solution to the challenge.

In such a system, the task team's leader is mainly responsible for:

- Working out and analyzing on an ongoing basis the running and suggested iterations,
- Coordinating the efforts between individual iterations; within an iteration, the "managing" specialist is held responsible;
- Providing constant risk assessment within project delivery;
- Shaping and maintaining high organizational culture within project delivery personnel; facilitating the sharing of undisclosed knowledge among team members, the cooperation within the project staff.
- Assuring effective communication within a task team and with the external subcontractors of a given iteration, so as to allow everyone involved to understand their respective roles and tasks. An important aspect of adaptive management is the maintenance of good relations and efficient communication with the customer / sponsor.

5. Adaptive management of the Pomeranian Metropolitan Railway project

The analyzed economic example is that of a construction project of the Pomeranian Metropolitan Railway, referred to as "PKM". The goal of the project was defined as designing and constructing a 20-kilometer railway line, along an old railway lane starting at the Gdańsk Wrzeszcz railway station, and running in the vicinity of the Gdańsk Airport. 8 new stations have been planned, 6 of which will serve as hubs, allowing the passengers to leave their cars or bicycles at the parking lot and continue their journey using the railway network. The general outline of the planned railway line is presented in Figure 3. The costs have been estimated at around 20 million euro, while the annual capacity of the new section of the transport infrastructure was set at between 6.5 and 10.3 million passengers. The railway line is to be serviced by 10 railbuses, running each 15 minutes in rush hour.

Fig. 3. Approved variant of the outline of the Gdańsk Metropolitan Railway, including the planned stations. Source: PKM SA.

Following the tasks and analyses of the initiation phase, due to their extremely discrepant character and content, a decision was undertaken to split the project into two sub-units (see Fig. 4), treated separately from methodological and subject matter viewpoints:

- Subproject 1: "Documentation of the investment", whose goal was to work out the functional solution concepts and formalize them, building up a documentation package for the construction activities. This project was dominated by information and decision processes with a large quantity of unknown values. The end product of

this subproject was documented knowledge and a legally binding decision to permit the construction of a railway line, as well as a decision securing sufficient funds for the planned activities.

- Subproject 2: "Construction" whose goal was to construct a railway line. This subproject was dominated by engineering, construction and logistic processes, whose product will be a physical object. The project will be conducted according to precise technical guidelines, according to approved documentation.

The sequence of phases and subprojects within the PKM project is presented in Fig. 4.

In case of the execution processes (the construction of the railway line itself) classical methods, employing typical project management tools and procedures work really well, but in preparatory activities of the information and decision-making processes, characterized by large uncertainty, it would be wise to search for new approaches.

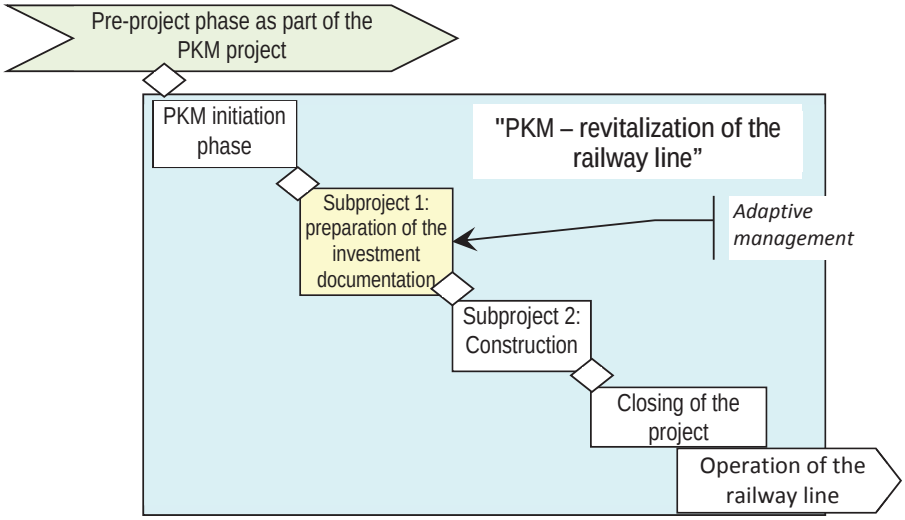

Fig. 4. The sequence of subprojects within the PKM project. Source: (Wirkus & Rudziński, 2013).

The application of the adaptive approach in the delivery of Subproject 1, regardless of whether this decision was a conscious one or not, was the result of the following:

- Lack of the knowledge as to what the end result of the project will be at the start of the endeavor; only general ideas existed, together with the vision of rebuilding the railway along its pre-war route;
- An innovative character of the constructed railway line and lack of prior technical solutions in the area;
- High project uncertainty and risk levels, resulting from fears as to whether the project can be completed at all, i.e. whether the railway may be constructed;
- No established decision-making methods for this type of infrastructure investment.

Beyond that, the project was characterized by a number of unknowns and controversies, related to the individual solutions that needed to be developed before the commissioning of the documentation for the construction of the railway line. These included, but were not limited to:

- Lack of detailed data on technical and usability measures that could be implemented in the construction of the railway line;
- Lack of detailed data on the possible construction costs;
- Lack of knowledge as to the time required to collect all the documents needed for the commencement of the construction work and the duration of the construction itself.

Developing the above unknowns into data was not limited to typical architecture and construction design work or the solving of problems typical of railway engineering. The problem area was complicated due to lack of

information and examples of similar past investments in other parts of the country. A large challenge resulted from the idea of constructing a railway line that would meet all the requirements of a modern transportation system (such as travel speed of the railbuses) in a demanding terrain. The unknowns in the area of the result of the project influenced the difficulty level of managing the subproject of preparing a suitable railway construction documentation package – i.e. it was difficult to assess the time it may take to develop satisfactory technical solutions. The primary goal of rebuilding the old railway line evolved and was adapted to conditions being gradually identified and decisions being undertaken; in parallel, the group of the interested parties also varied in its member composition. Insufficiently developed definitions of the project's fundamental parameters seriously influenced the budgeting process, including the inability to pinpoint the potential sources of financing.

Difficulties in applying the classic management approach to the Subproject 1 from its documentation viewpoint caused the project to be executed with an uncertain degree of formalization, based on the adaptive approach. According to such an approach, preparation of the necessary documentation was divided into a number of iterations, forming analytical and design entities of parallel or sequential nature, and taking into account the subject matter of the individual iterations, as well as the sequence in which knowledge is being built in a project. The process is shown in Fig. 5. Many iterations included analyses of different variants of the suggested solutions. The results developed in each iteration were scrutinized and implemented or adapted in subsequent iterations.

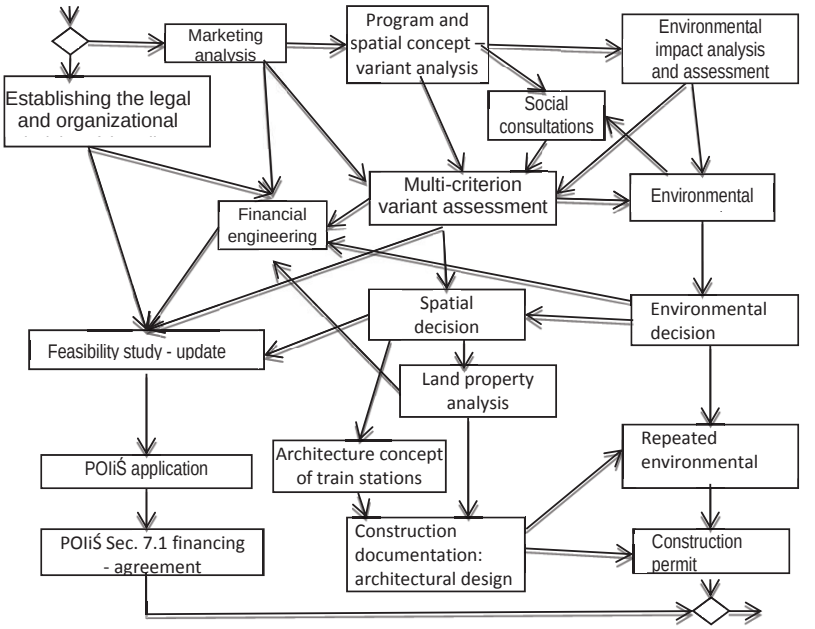

Fig. 5. Iterations and information links within Subproject 1: "preparation of the investment documentation". Source: (Wirkus & Rudziński, 2013).

The approach, apart from dividing the project into smaller parts – iterations – also relied on the following principles:

- Establishing a timeline of the project activities based on milestones;
- Ongoing risk management;
- Providing information and collecting opinions of the interested parties related to the solutions being developed in individual iterations on an ongoing basis, including consulting with the community members;
- Regular meetings of the project team, consisting mainly of the employees of PKM SA, during which an ongoing analysis of results obtained in individual iterations was performed, and tasks for future iterations were planned.

A vital element of the adaptive development of solutions in the PKM project was the analysis of more than one possible outcome. At one point, all but one alternative were discarded. After developing the details of the given solution and obtaining approval of the main interested parties, the solution was treated as binding and "frozen". Such an accepted work method was basis for activity in the subsequent iterations.

The sponsor, i.e. the Executive Board of the Pomeranian Voivodeship, built a team of specialists for the purposes of the execution of the PKM project, organized as a project structure and having a legal form of a special purpose vehicle of the same name. The core of the team consisted of contracted employees of the legal vehicle. An important factor to the success of the project was continuous support thereof by the sponsor whose role was that of a stimulant and supervisor of the endeavor. The sponsor – in this capacity – also promoted and secured the execution of the project in uncertain or crisis situations.

7. Summary

In a typical project, after the initiation and planning phase, the participants know what needs to be done and how the said goal is to be achieved; therefore managing such a project seems easier. In a project that does not define its success throughout most of its lifecycle, a need to implement other solution arises. Such needs may be addressed by adaptive management. As the analyses within the scrutinized economic practice project have proven, adaptive management is very useful in project execution if the initiation phase brings only the goal to be achieved, at the same time lacking in precise definition of the said goal which in some cases may not even be possible to define. Frequently, data helping to achieve the project goal is also missing.

The analyses and experience collected during the execution of the documentation subproject of the PKM endeavor allow for a conclusion that the following concepts are relevant to the adaptive approach and the success of such a managed project:

- Execution of the tasks in the project following their division into several flexible iterations. It is important to assure logical sequencing and correlation among the achievements of the individual iterations, and within these iterations it is vital to generate and approximate the solution on an ongoing basis, often based on multi-variant analyses of the possible outcomes; after one of these solutions has been accepted it ought to be treated as "frozen". The outcome of each iteration enriches the knowledge database of the project which in turn is made available for use in subsequent iterations.
- Cooperating with the sponsor / customer, including remaining open to the needs of the sponsor, consulting the results of a given iteration with the sponsor and – based on the results of the consultation – assessing the overall project condition and planning future iterations.

Other factors which contribute to the efficiency of the adaptive approach are:

- Continuous planning after concluding an iteration, with as wide scope as is allowed by the current state of project knowledge. Planning ought to cover all the aspects of the analyzed endeavor, starting with continuous specification of the goals of the project (with business justification), through the ongoing adaptation of the scope of the project, taking into account the changes generated by the project environment in real time;
- Having project management possessing not only subject knowledge about the project, but also specific social skills, including the ability to boost their subordinates' creativity. It is a desirable situation to have the team management not fear the change, have the ability to steer it properly, be firm and consistent, but at the same time flexible;
- Monitoring the reactions of the external interested parties regarding the results and decisions in the project's environment.
- Identifying and preventing problem situations, as early as feasible, through ongoing consistent risk management in project execution.

In adaptive approach to project management, the value of success measures (time, costs, quality – results) are also adapted according to the conditions in the project's environment and gradually achieved results. The approach applied to the PKM documentation subproject was characterized by certain amounts of chaos and random activity,

but the analyses proved the usefulness of the adaptive approach in similar projects. Specific solutions developed in the said project ought to be adapted to individual endeavors and the specifics of the organization that runs a project.

References

PMI (2013) *A Guide to the Project Management Body of Knowledge; PMBOK® Guide*. (5 rd ed.).

Schwaber K. (2005). *Sprawne zarządzanie projektami metodą Scrum.* Warsaw: APN Promise.

Virine L. (2008). Adaptive Project Management. *PM World Today, May (Vol. X, Issue V)*

Wirkus M., Węsierski T. (2011). Adaptacyjne podejmowanie decyzji w zakładzie ceramiki budowlanej [in:] *Knosala R. (ed.), Komputerowo zintegrowane zarządzanie, Opole: Oficyna Wydawnicza PTZP, Vol. II, pp. 547 – 556.*

Wirkus M., Rudziński K. (2013). Pomorska Kolej Metropolitarna - adaptacyjne zarządzanie przygotowaniem projektu infrastrukturalnego. [in:] *Zarządzanie – programy, projekty, procesy. Teoria i rozwiązania praktyczne. Warszawa: DIFIN, pp. 82 – 121.*

Wysocki R. K., McGary R. (2005). *Efektywne zrządzanie projektami*, (3rd ed.). Gliwice: Helion.